



Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents with HIV.

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Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 1 of 8) (Last updated October 22, 2019; last reviewed October 22, 2019)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Acyclovir	IV Dose <i>Serious HSV:</i> • 5 mg/kg IV every 8 hours <i>VZV Infections:</i> • 10 mg/kg IV every 8 hours	26–50	100% of dose IV every 12 hours
		10–25	100% of dose IV every 24 hours
		<10	50% of dose IV every 24 hours
	PO Dose for Herpes Zoster: 800 mg PO five times/day	HD	50% of dose every 24 hours; administer dose after HD on day of dialysis.
		10–25	800 mg PO every 8 hours
		<10	800 mg PO every 12 hours
Adefovir	10 mg PO every 24 hours	HD	800 mg PO every 12 hours; administer dose after HD on day of dialysis
		30–49	10 mg PO every 48 hours
		10–29	10 mg PO every 72 hours
Amikacin For mycobacterial infections	IV 15 mg/kg per day <i>or</i> 25 mg/kg three times per week	HD	10 mg PO weekly; administer dose after HD
		Use with caution in patients with renal insufficiency and family history of ototoxicity.	Adjust dose based on serum concentrations with target peak concentration 35–45 mcg/mL and trough concentration <4 mcg/mL. Administer dose after HD on day of dialysis.
Amphotericin B	0.7–1.0 mg/kg IV per day (amphotericin B deoxycholate) <i>or</i> 3–6 mg/kg IV per day (lipid formulation)	N/A	No dosage adjustment necessary; consider alternative antifungals if renal insufficiency occurs during therapy despite adequate hydration.
		Use with caution in patients with renal insufficiency.	Adjust dose based on serum concentrations with target peak concentration 35–45 mcg/mL and trough concentration <4 mcg/mL. Administer dose after HD on day of dialysis.
Capreomycin	15 mg/kg IV or IM per day	Use with caution in patients with renal insufficiency.	Adjust dose based on serum concentrations with target peak concentration 35–45 mcg/mL and trough concentration <4 mcg/mL. Administer dose after HD on day of dialysis.
Chloroquine (Base)	For Treatment of Acute Malaria: • 1 g (600 mg base) PO for 1 dose, followed by 500 mg (300 mg base) PO at 6, 24, and 48 hours (for a total dose of 1,500 mg)	<10	50% of dose
Cidofovir	5 mg/kg IV on Day 0, repeat 5 mg/kg IV dose on Day 7, then 5 mg/kg IV every 2 weeks Give each dose with probenecid and saline hydration (see Table 2 for dosing instructions).	Pretreatment SCr >1.5 mg/dL <i>or</i> CrCl <55 mL/min <i>or</i> Proteinuria ≥100 mg/dL (≥2 +)	Cidofovir is not recommended.
		If SCr increases by 0.3–0.4 mg/dL above baseline	Decrease to 3 mg/kg IV per dose
		If SCr increases >0.5 mg/dL above baseline <i>or</i> Proteinuria ≥3 +	Discontinue therapy

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 2 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Ciprofloxacin	500–750 mg PO every 12 hours <i>or</i> 400 mg IV every 8–12 hours	30–50	500–750 mg PO every 12 hours <i>or</i> 400 mg IV every 12 hours
		<30	250–500 mg PO every 24 hours <i>or</i> 400 mg IV every 24 hours
		HD or PD	250–500 mg PO every 24 hours <i>or</i> 200–400 mg IV every 24 hours; administer after HD or PD on day of dialysis.
Clarithromycin	500 mg PO every 12 hours	30–60	Usual dose except when used with an HIV PI or with COBI, then reduce dose by 50%.
		<30	250 mg PO twice daily <i>or</i> 500 mg PO once daily If used with an HIV PI or COBI, reduce dose by 75% (or consider using azithromycin as alternative).
Cycloserine	10–15 mg/kg/day PO in two divided doses (maximum 1,000 mg/day); start at 250 mg once daily and increase dose per tolerability	50–80	Usual dose; consider monitoring serum concentration and toxicities.
		<50 (not on HD)	Monitor serum concentrations (target peak concentration 20–35 mcg/mL) and adjust dose accordingly. Use with caution in patients with ESRD who are not on dialysis.
		HD	250 mg PO once daily or 500 mg PO three times per week; monitor serum cycloserine concentration (target peak concentration 20–35 mcg/mL).
Emtricitabine (FTC)	One 200-mg tablet PO once daily <i>or</i> 240 mg solution PO once daily	30–49	Oral Tablets: 200 mg every 48 hours Oral Solution: 120 mg every 24 hours
		15–29	Oral Tablets: 200 mg every 72 hours Oral Solution: 80 mg every 24 hours
		<15 or HD (administer dose after dialysis)	Oral Tablets: 200 mg every 96 hours Oral Solution: 60 mg every 24 hours
Emtricitabine/Tenofovir Alafenamide (FTC/TAF) (FDC Trade Name: Descovy) Note: Please refer to product information for dosing recommendations for other ARV FDC products containing FTC/TAF.	One (FTC 200 mg/TAF 25 mg) tablet PO once daily	<30	Coformulated tablet is not recommended .

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 3 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Emtricitabine/Tenofovir Disoproxil Fumarate (FTC/TDF) (FDC Trade Name: Truvada) Note: Please refer to product information for dosing recommendations for other ARV FDC products containing FTC/TDF.	One (FTC 200 mg/TDF 300 mg) tablet PO daily	30–49	1 tablet PO every 48 hours (monitor for worsening renal function or consider switching to TAF)
		<30 or HD	Do not use coformulated tablet in patients with CrCl <30 mL/min. Use formulation for each component drug and adjust dose according to recommendations for the individual drugs.
Entecavir Usual Dose: 0.5 mg PO once daily For Treatment of 3TC-Refractory HBV or for Patients with Decompensated Liver Disease: 1 mg PO once daily		30 to <50	Usual Renal Dose Adjustment: • 0.25 mg PO every 24 hours, <i>or</i> • 0.5 mg PO every 48 hours 3TC-Refractory or Decompensated Liver Disease: • 0.5 mg PO every 24 hours, <i>or</i> • 1 mg PO every 48 hours
		10 to <30	Usual Renal Dose Adjustment: • 0.15 mg PO every 24 hours, <i>or</i> • 0.5 mg PO every 72 hours 3TC-Refractory or Decompensated Liver Disease: • 0.3 mg PO every 24 hours, <i>or</i> • 1 mg PO every 72 hours
		<10 or HD or CAPD (administer after HD or CAPD on dialysis day)	Usual Renal Dose Adjustment: • 0.05 mg PO every 24 hours, <i>or</i> • 0.5 mg PO once every seven days 3TC-Refractory or Decompensated Liver Disease: • 0.1 mg PO every 24 hours, <i>or</i> • 1 mg PO once every seven days
Ethambutol For MAI: 15 mg/kg PO daily For MTB: 15–25 mg/kg PO daily (See Table 3 for additional MTB dosing recommendations.)		<30 or HD	Usual dose PO three times weekly (in patients on HD, give dose after dialysis) Consider TDM to guide optimal dosing.
Ethionamide 15–20 mg/kg PO daily (usually 250–500 mg PO once or twice daily)		<30 or HD	250–500 mg PO once daily
Famciclovir For Herpes Zoster: 500 mg PO every 8 hours For HSV: 500 mg PO every 12 hours		40–59	500 mg PO every 12 hours
		20–39	500 mg PO every 24 hours
		<20	250 mg PO every 24 hours
		HD	250 mg PO only on HD days, administer after HD

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 4 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Fluconazole	200–1,200 mg PO or IV every 24 hours (dose and route of administration depends on type of OI)	≤50	50% of dose every 24 hours
		HD	Administer full dose after HD on days of dialysis
Flucytosine	25 mg/kg PO every 6 hours TDM is recommended for all patients to guide optimal dosing (target peak serum concentration 2 hours after dose: 30–80 mcg/mL).	21–40	25 mg/kg PO every 12 hours
		10–20	25 mg/kg PO every 24 hours
		<10	25 mg/kg PO every 48 hours
		HD	25–50 mg/kg PO every 48–72 hours; administer dose after HD
Foscarnet	Induction Therapy for CMV Infection: 180 mg/kg/day IV in two divided doses Maintenance Therapy for CMV Infection or for Treatment of HSV Infections: 90–120 mg/kg IV once daily	Dosage adjustment needed according to calculated CrCl/kg; consult product label for dosing table.	Dosage adjustment needed according to calculated CrCl/kg; consult product label for dosing table.
Ganciclovir	Induction Therapy: 5 mg/kg IV every 12 hours	50–69	2.5 mg/kg IV every 12 hours
		25–49	2.5 mg/kg IV every 24 hours
		10–24	1.25 mg/kg IV every 24 hours
		<10 or HD	1.25 mg/kg IV three times per week; administer dose after HD on days of dialysis
	Maintenance Therapy: 5 mg/kg IV every 24 hours	50–69	2.5 mg/kg IV every 24 hours
		25–49	1.25 mg/kg IV every 24 hours
		10–24	0.625 mg/kg IV every 24 hours
		<10 or HD	0.625 mg/kg IV three times per week; administer dose after HD on days of dialysis
Lamivudine (3TC)	300 mg PO every 24 hours	30–49	150 mg PO every 24 hours
		15–29	150 mg PO once, then 100 mg PO every 24 hours
		5–14	150 mg PO once, then 50 mg PO every 24 hours
		<5 or HD	50 mg PO once, then 25 mg PO every 24 hours; administer dose after HD on dialysis day
Lamivudine/Tenofovir Disoproxil Fumarate (3TC/TDF) (FDC Trade Names: Cimduo or Temixys) Note: Please refer to product information for dosing recommendations for other ARV FDC products containing 3TC/TDF.	One (3TC 300 mg/TDF 300 mg) tablet PO every 24 hours	<50	Coformulated tablet is not recommended .
Ledipasvir/Sofosbuvir	One (ledipasvir 90 mg/sofosbuvir 400 mg) tablet PO once daily	<30	Co-formulated tablet is not recommended . No dose has been established because of up to 20-fold higher sofosbuvir metabolite observed at this level of renal impairment.

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 5 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Levofloxacin	500 mg (low dose) or 750-1,000 mg (high dose) IV or PO daily	20–49	Low Dose: 500 mg once, then 250 mg every 24 hours, IV or PO High Dose: 750 mg every 48 hours IV or PO
		<20 or CAPD or HD (administer dose after HD or CAPD on days of dialysis)	Low Dose: • 500 mg once, then 250 mg every 48 hours, IV or PO • Dose can be adjusted based on serum concentrations. High Dose: 750 mg once, then 500 mg every 48 hours, IV or PO
Para-aminosalicylic acid	8–12 g/day PO in two to three divided doses	<30 or HD	4 g PO twice daily; administer after HD on days of dialysis
Paromomycin	500 mg PO every 6 hours	<10	Minimal systemic absorption. No dosage adjustment necessary, but monitor for worsening renal function and ototoxicity in patients with ESRD.
Peginterferon Alfa-2a	180 mcg SQ once weekly	<30	135 mcg SQ once weekly
		HD	135 mcg SQ once weekly
Peginterferon Alfa-2b	1.5 mcg/kg SQ once weekly	30–50	Reduce dose by 25%
		10–29 and HD	Reduce dose by 50%
Penicillin G (Potassium or Sodium)	Neurosyphilis, Ocular Syphilis, or Otosyphilis: • 3–4 million units IV every 4 hours, <i>or</i> • 18–24 million units IV daily as continuous infusion	10–50	2–3 million units every 4 hours <i>or</i> 12–18 million units as continuous infusion
		<10	2 million units every 4–6 hours <i>or</i> 8–12 million units as continuous infusion
		HD or CAPD	2 million units every 6 hours <i>or</i> 8 million units as continuous infusion
Pentamidine	4 mg/kg IV every 24 hours	10–50	3 mg/kg IV every 24 hours
		<10	4 mg/kg IV every 48 hours
Posaconazole	IV: 300 mg twice daily on Day 1; then 300 mg once daily	<50	No dosage adjustment of oral dose in patients with renal insufficiency. Higher variability in serum concentrations observed in patients with CrCl <20 mL/min. Monitor posaconazole concentrations (target trough concentration >1.25 mcg/mL). IV posaconazole is not recommended by the manufacturer because of potential toxicity due to accumulation of sulfobutylether cyclodextrin (vehicle of IV product). However, an observational study did not find worsening in renal function in patients with CrCl <50 mL/min given sulfobutylether cyclodextrin. Switch patients with CrCl <50 mL/min to oral posaconazole when feasible.
	Delayed-Release Tablet: 300 mg PO once daily Oral Suspension: 400 mg PO twice daily		
Pyrazinamide	See Table 3 for weight-based dosing guidelines.	<30 or HD	25–35 mg/kg/dose three times per week; administer dose after HD on dialysis days

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 6 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Quinidine Gluconate (Salt) Note: 10 mg quinidine gluconate salt = 6.25 mg quinidine base	10 mg/kg (salt) IV over one to two hours, then 0.02 mg/kg/min (salt) IV for up to 72 hours or until able to take oral meds	<10	75% of usual dose
		HD	75% of usual dose; some clinicians recommend supplementation with 100–200 mg IV after HD on days of dialysis. Consider TDM for all patients to optimize dosing.
Quinine Sulfate	650 mg salt (524 mg base) PO every 8 hours	<10 or HD	650 mg once, then 325 mg PO every 12 hours
Ribavirin	For Genotypes 1 and 4: 1,000–1,200 mg PO per day in two divided doses (based on weight; see Table 2 for full dosing recommendation) For Genotypes 2 and 3: 400 mg PO twice daily	30–50	Alternate dosing 200 mg PO and 400 mg PO every other day
		<30 or HD	200 mg PO daily (based on limited data)
Rifabutin	5 mg/kg PO daily (usually 300 mg PO daily) See Table 3 and Drug-Drug Interactions in the Adult and Adolescent Antiretroviral Guidelines for dosage adjustment based on interactions with ARVs.	<30	Consider 50% of dose once daily if toxicity is suspected. Monitor serum concentration and adjust dose as needed.
Rifampin	10 mg/kg PO daily (usually 600 mg PO daily)	<30 or HD	600 mg once daily, or 600 mg three times per week
Sofosbuvir	400 mg PO daily	<30	Not recommended. Up to 20-fold higher sofosbuvir metabolite observed in patients with this level of renal impairment.
Streptomycin	15 mg/kg IM or IV every 24 hours <i>or</i> 25 mg/kg IM or IV three times per week	Use with caution in patients with renal insufficiency.	Adjust dose based on serum concentrations. Administer dose after dialysis on day of dialysis.
Sulfadiazine	1,000–1,500 mg PO every 6 hours (1,500 mg every 6 hours for patients >60 kg)	10–50	1,000–1,500 mg PO every 12 hours (ensure adequate hydration)
		<10 or HD	1,000–1,500 mg PO every 24 hours; administer dose after HD on days of dialysis
Telavancin	10 mg/kg IV every 24 hours	31–50	7.5 mg/kg IV every 24 hours (decreased clinical cure rate with CrCl <50 mL/minute; use with caution)
		10–30	10 mg/kg IV every 48 hours (decreased clinical cure rate with CrCl <50 mL/minute; use with caution)
		<10	Insufficient clinical data to recommend routine use. Use with caution due to decreased clinical cure rate with CrCl <50 mL/minute. If no other option, consider 10 mg/kg every 48 hours IV or 10 mg/kg IV post-HD three times a week (based on observational study [n = 10]).

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 7 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Telbivudine	600 mg PO daily	30–49	Oral Tablets: 600 mg PO every 48 hours Oral Solution: 400 mg PO every 24 hours
		<30	Oral Tablets: 600 mg PO every 72 hours Oral Solution: 200 mg PO every 24 hours
		HD	Oral Tablets: 600 mg PO every 96 hours; administer dose after dialysis. Oral Solution: 120 mg PO every 24 hours; administer dose after HD on dialysis day
Tenofovir Alafenamide (TAF)	25 mg PO daily	<15	Not recommended
		<15 on HD	No dosage adjustment required. Administer dose after HD on dialysis days.
Tenofovir Disoproxil Fumarate (TDF)	300 mg PO daily	30–49	300 mg PO every 48 hours (consider switching to TAF for treatment of HBV)
		10–29	300 mg PO every 72–96 hours (consider switching to alternative agent for treatment of HBV)
		<10 and not on dialysis	Not recommended
		HD	300 mg PO once weekly; administer dose after dialysis
Tetracycline	250 mg PO every 6 hours Consider using doxycycline in patients with renal dysfunction.	10–49	250 mg PO every 12–24 hours
		<10	250 mg PO every 24 hours
		HD	250 mg PO every 24 hours; administer dose after dialysis
Trimethoprim/Sulfamethoxazole (TMP-SMX)	For PCP Treatment: • 5 mg/kg (of TMP component) IV every 6–8 hours, <i>or</i> • Two TMP-SMX DS tablets PO every 8 hours	15–30	5 mg/kg (TMP) IV every 12 hours, or two TMP-SMX DS tablets PO every 12 hours
		<15	5 mg/kg (TMP) IV every 24 hours, or one TMP-SMX DS tablet PO every 12 hours (or two TMP-SMX DS tablets every 24 hours)
		HD	5 mg/kg/day (TMP) IV, or two TMP-SMX DS tablets PO; administer dose after HD on dialysis day. Consider TDM to optimize therapy (target TMP concentrations: 5–8 mcg/mL)
	For PCP Prophylaxis: • One TMP-SMX DS tablet PO daily; • One TMP-SMX DS tablet PO three times per week; <i>or</i> • One TMP-SMX SS tablet PO daily	15–30	Reduce dose by 50%
		<15	Reduce dose by 50% or use alternative agent
	For Toxoplasmosis Encephalitis (TE) Treatment: 5 mg/kg (TMP component) IV or PO every 12 hours	15–30	5 mg/kg (TMP component) IV or PO every 24 hours
		<15	5 mg/kg (TMP component) IV or PO every 24 hours or use alternative agent

Table 7. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Patients with Renal Insufficiency (page 8 of 8)

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl (mL/min)*	Dose
Trimethoprim/ Sulfamethoxazole (TMP-SMX), continued	For TE Chronic Maintenance Therapy: • One TMP-SMX DS tablet twice daily, <i>or</i> • One TMP-SMX DS tablet daily	15–30	Reduce dose by 50%
		<15	Reduce dose by 50% or use alternative agent
	For Toxoplasmosis Primary Prophylaxis: One TMP-SMX DS tablet PO daily	15–30	Reduce dose by 50%
		<15	Reduce dose by 50% or use alternative agent
Valacyclovir	For Herpes Zoster: 1 g PO three times daily	30–49	1 g PO every 12 hours
		10–29	1 g PO every 24 hours
		<10	500 mg PO every 24 hours
		HD	500 mg PO every 24 hours; dose after HD on dialysis days
Valganciclovir	Induction Therapy: 900 mg PO twice daily Maintenance Therapy: 900 mg PO once daily	40–59	Induction: 450 mg PO twice daily Maintenance: 450 mg PO daily
		26–39	Induction: 450 mg PO daily Maintenance: 450 mg PO every 48 hours
		10–25	Induction: 450 mg PO every 48 hours Maintenance: 450 mg PO twice weekly
		<10 and not on dialysis	Induction: Not recommended Maintenance: Not recommended
		HD Note: Clinical efficacy of these doses has not been established.	Induction: 200 mg (oral powder formulation) PO three times per week after HD Maintenance: 100 mg (oral powder formulation) PO three times per week after HD
Voriconazole	6 mg/kg IV every 12 hours for two doses, then 4 mg/kg IV every 12 hours <i>or</i> 200–300 mg PO every 12 hours	<50	IV voriconazole is not recommended by the manufacturer because of potential toxicity due to accumulation of sulfobutylether cyclodextrin (vehicle of IV product). An observational study did not find worsening in renal function in patients with CrCl <50 mL/min. Switch patients with CrCl <50 mL/min to oral voriconazole when feasible. No need for dosage adjustment when the oral dose is used. Adjust dose based on serum concentrations.

Key: 3TC = lamivudine; ARV = antiretroviral; CAPD = continuous ambulatory peritoneal dialysis; CMV = cytomegalovirus; COBI = cobicistat; CrCl = creatinine clearance; DS = double strength; ESRD = end-stage renal disease; FDC = fixed-dose combination; FTC = emtricitabine; HBV = hepatitis B virus; HD = hemodialysis; HSV = herpes simplex virus; IM = intramuscular; IV = intravenous; MAI = *Mycobacterium avium intracellulare*; MTB = *Mycobacterium tuberculosis*; N/A = not applicable; OI = opportunistic infection; PD = peritoneal dialysis; PCP = *Pneumocystis pneumonia*; PI = protease inhibitor; PO = orally; SCr = serum creatinine; SQ = subcutaneous; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; TDM = therapeutic drug monitoring; TMP-SMX = trimethoprim-sulfamethoxazole; VZV = varicella zoster virus

* Creatinine Clearance Calculation

Male:

$$\frac{(140 - \text{age in years}) \times (\text{weight in kg})}{72 \times (\text{serum creatinine})}$$

72 x (serum creatinine)

Female:

$$\frac{(140 - \text{age in years}) \times (\text{weight in kg}) \times (0.85)}{72 \times (\text{serum creatinine})}$$

72 x (serum creatinine)